literature at my disposal. This letter may serve, I hope, to initiate such experiments, or to bring to our notice in Nigeria work already done.

W. E. McCULLOCH.

Dietetics Research Laboratory,
Katsina, Northern Nigeria, B.W.A.,
Dec. 18.

[1] "An Enquiry into the Dietaries of the Hausa and Town Fulani of Northern Nigeria, with some observations of the effects on the National Health, with recommendations arising therefrom." W. E. McCulloch, *West African Medical Journal*, **3**; 1929–30.

Determination of the Velocities of Projectiles by the Method of Light Interception.

MESSRS. Payman and Woodhead appear to have misunderstood the method described in our letter in NATURE of Dec. 27, p. 994. We made no claim to originality of application of the principle of light interception. Our method does not depend on shadow or ordinary photography, which has been used in ballistics since the time when Boys took his first shadow photographs in 1893, and differs from that used in other optical chronographs (see, for example, Cranz, "Experimentelle Ballistik", **3**, chap. ii., 1927), of which Kampé de Fériet's is one.

Fériet's method consists in taking a continuous photograph of the projectile itself, by ordinary daylight photography, on a plate moving at right angles to the direction of flight. The records show a band at an angle to the direction of motion of the plate. The velocity determination involves the measurement of this angle. There are no discreet interceptions as in our records.

In our method the motion of the film of the camera (which is a simple drum-camera with a cylindrical lens at the shutter, not a 'photographic' camera in the ordinary sense) is parallel to the axis of flight. The projectile eclipses one or more beams of light which are brought to a fine focus (less than one millimetre) on the line of flight, and it is these eclipses or interceptions of the beams by the body of the projectile in flight which are recorded, not the reduced shadow images of the projectile. In Fériet's method there is no 'range' in the technical sense; in our method the 'range' is the accurately measured distance between the two foci of the interception beams on the line of flight. Fériet's camera gives the ratio—velocity of projectile to velocity of plate—whereas our camera simply gives a time interval between the eclipses by the body of the projectile of two fine beams of light placed a known distance apart. The difference is obvious when it is realised that a velocity determination can be made from Fériet's photographs alone, without other data, whereas from our photographs it is not possible to determine a velocity unless the 'range' is known.

Since the publication of our original letter in NATURE of Dec. 27, 1930, we have learned through the courtesy of the Director of Ballistics Research, Woolwich, that a method on the same principle as our own was developed by Thompson, Hickman and Riffolt and published in the *Proceedings* of the U.S. National Academy of Sciences (*Proc.*, **6**, 169, April 1920). These workers utilised a single narrow beam of light, whereas we utilise two finely focused beams: the illuminating and recording apparatus is different but the principle is the same.

JAMES TAYLOR.
ROBERT WARK.

Research Department (Nobel Section),
Imperial Chemical Industries,
Stevenston, Ayrshire.

Embryology and Evolution.

IN the issue of NATURE for Dec. 13, Mr. G. L. Purser gives us an analogy of the modern manufacture of motor cars as a contribution to the solution of the problem of embryonic evolution which is novel and interesting, but far from satisfactory.

The comparison of the function of the hypothetical gene to that of an intelligent workman is but adding to the mystery. Often the workman in the modern factory functions merely as the trigger-release of processes altogether beyond his ken, and subservient to the will and preconceptions of the motor car designer. The more excellent the machine, the less dependent it is upon the control of the workman-intermediary; but however excellent the machine, the sole origin of that excellence lies obscurely hidden in the phenomenon we term intelligence. Devoid of motive power, the most excellent of all machines stands immobile. It cannot move productively unless, again by some intelligence, a motive force is accurately applied, and the moment this force ceases to reach it, the machine stops.

Most of us before we reach the age of ten have learnt that anything which 'goes' is driven by a force external, yet although we live to be a hundred, what a host of us regard with sublime abhorrence the suggestion that the same thing is likely to be true in regard to living cells! We willingly accept the validity of 'kinetic', 'electrical', gravitational', or other forces, but we dogmatically affirm that a 'vital' force is but a bogy from the limbo of fantastic superstition; and so we evoke the genie, perhaps the gene, and by its spell try to account for all we see—with as much success as if we claimed that the revolving flywheel of our motor engine were the real source of its motive power.

Personally, I feel that incredulity of a 'vital' force is scarcely any longer compatible with true scientific observation. Anyone who has studied mitotic division of the cell and is conversant with electro-physical phenomena feels instinctively that he is observing the action of a force strikingly similar to that of the magnetic field. Irradiation with ultra-violet light is found to augment the process of ovulation in the domestic fowl, while the reproduction of fur-bearing animals in northern lands is strangely correlated with magnetic solar radiation.

Entelechy, like the word phlogiston, may be the signpost on the way to a new enlightenment, which will, I predict, ere long result in the acceptance of the view that the living cell is, after all, merely a machine primarily operated by some external force. Even so, let us remember that vitalism and spiritualism are not synonymous.

MALCOLM E. MACGREGOR.

Wellcome Field Laboratory,
Wisley, Surrey.

Use of Tungsten Arc Lamps for Photomicrography.

THE uniform intrinsic brilliancy and compactness of the tungsten arc lamp have led to its extensive application as an illuminant for photomicrography. It does not appear to be generally recognised, however, that the light which leaves the metal surface at angles approaching a tangent is so strongly plane polarised that it is difficult to obtain uniform illumination when crystals are being photomicrographed by plane polarised light.

The polarised light emitted at an acute angle to the incandescent metal surface has its vibration direction parallel to that surface. This effect may be shown by projecting an image of the incandescent tungsten sphere on to a white screen by means of a 2-inch objective, and then interposing a Nicol prism